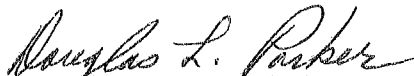


DAMAGE SURVEY & BIOLOGICAL EVALUATION
Engelmann Spruce Beetle in
Engelmann Spruce
Manti-LaSal National Forest
1973

Prepared by:



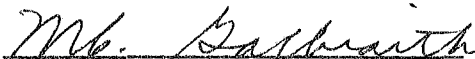
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DAMAGE SURVEY & BIOLOGICAL EVALUATION

Engelmann Spruce Beetle in Engelmann Spruce

Price Ranger District

1973

INTRODUCTION

The Engelmann spruce beetle infestation on the Manti-LaSal National Forest has caused heavy Engelmann spruce mortality in the upper reaches of Huntington Canyon. The outbreak was first detected in 1970 during the annual aerial survey and increases in the intensity and extent of tree mortality were observed in succeeding years.

In 1973, on-the-ground surveys were conducted in Lake and Swens Canyons and Spring Creek to acquire information on tree losses caused by this beetle. It is hoped that this information will assist land managers in making timber management decisions.

GENERAL INFORMATION

Insect: Engelmann spruce beetle, Dendroctonus rufipennis (Kirby)
(Coleoptera:Scolytidae).

Host Tree: Engelmann spruce, Picea engelmannii (Parry).

Location: Price Ranger District, Manti-LaSal National Forest.

Type of Damage: Killing of Engelmann spruce.

Extent of Damage: Most tree killing has occurred in the Huntington Creek drainage from Mill Canyon north to Brooks Canyon (Figure 1, Appendix). Scattered tree losses also occurred in the upper side drainages of Pleasant Valley Creek.

METHODS

Surveys were conducted in Engelmann spruce, subalpine fir, and aspen stands. The areas sampled in Lake Canyon and Spring Creek were on north-facing slopes at about 8,800 feet in elevation (Figure 2, Appendix). In Swens Canyon, the survey was conducted on a west-facing slope at about 8,600 feet in elevation (Figure 3, Appendix). The sizes of the survey tracts were as follow: Lake Canyon, 105 acres; Spring Creek, 160 acres; Swens Canyon, 45 acres.

Sample plots were systematically located in each area. Two types of plots were utilized. Strip plots (1/2 acre) were used to obtain estimates of trees killed by the Engelmann spruce beetle. Twenty-one strip plots were sampled in Lake Canyon, 32 in Spring Creek, and 15 in Swens Canyon. Variable plots (10 BAF) were used to obtain estimates of living trees. Forty-five, 68, and 33 variable plots were sampled in Lake Canyon, Spring Creek, and Swens Canyon, respectively.

For volume estimates, the height of the first "count" tree on every variable plot was measured. All height measurements were averaged for each diameter class and the mean height figure was used for volume calculations. However, the heights of only a few trees above 20 inches in diameter were measured, and a mean height could not be calculated. Accordingly, a height of 90 feet, which probably will yield an underestimate of volume, was assumed for diameter classes 20 inches and above.

RESULTS

Lake Canyon: Cumulatively, the Engelmann spruce beetle killed 14.2 Engelmann spruce trees per acre, 5 inches in diameter and above in this drainage (Table 1, Appendix). Approximately 14 percent of the Engelmann spruce type and 10 percent of the total stand was killed.

A summary of volume estimates for Engelmann spruce in board feet per acre (Scribner) in the Lake Canyon tract follows: Total, 17,256; live, 12,726; dead, 4,530. Twenty-six percent of the volume of Engelmann spruce was in dead trees.

Statistical estimators of sample populations are listed in Table 4.

The outbreak is expected to continue at a relatively high level in this drainage. Beetle broods were abundant and appeared healthy. Hibernating adults were found at the base of trees attacked in 1972 and eggs and small larvae were observed in 1973 attacked trees. Since this beetle generally has a 2-year life cycle, the presence of

hibernating adults in 1972 attacked trees and eggs and small larvae in 1973 attacked trees indicates there are staggered populations. Many of the larger diameter trees, which are most susceptible to beetle attack, are still alive and these trees will enable the beetle population to remain at a high level. In addition, losses in smaller diameter trees should increase in 1974.

Spring Creek: Aerial survey maps indicate that Engelmann spruce losses have been heavier in this stand than in any other in Huntington Canyon (Figure 4, Appendix). Cruise data corroborate these observations. Fifty-eight percent of the Engelmann spruce and 29 percent of the stand was dead (Table 2, Appendix). As a result of the heavy mortality of large diameter trees, 82 percent of the volume was in dead trees. There was a total of about 16,773 board feet per acre of Engelmann spruce with 3,012 board feet in live trees and 13,761 in dead trees.

Statistical estimators of sample populations are listed in Table 4.

Even though most of the large trees have been killed, the outbreak will continue in this area. Mortality of smaller diameter trees (6 to 17 inches in diameter) should increase. Nevertheless, the outbreak probably has reached its peak in this stand and should start to decline in 1974. As in Lake Canyon, the broods appeared healthy in most trees and the same stages were observed.

Swens Canyon: The Engelmann spruce beetle killed 33 percent of the Engelmann spruce trees and 17 percent of the stand (Table 3, Appendix). Seventy-three percent of the volume of Engelmann spruce was in dead trees. Volume estimates in board feet per acre were as follow: Total, 12,626; live, 3,465; dead, 9,160.

Statistical estimators of sample populations are listed in Table 4.

Additional losses will occur in this area in 1974. Many smaller diameter trees will be killed before the outbreak subsides. The condition, abundance, and stages of broods were similar to what was observed in the other cruise areas.

DISCUSSION

The only factor that will probably end this infestation is the eventual elimination of most of the Engelmann spruce trees above 8 inches in diameter. Many trees below 8 inches in diameter possibly will be killed in some stands. Over 90 percent of the merchantable

APPENDIX

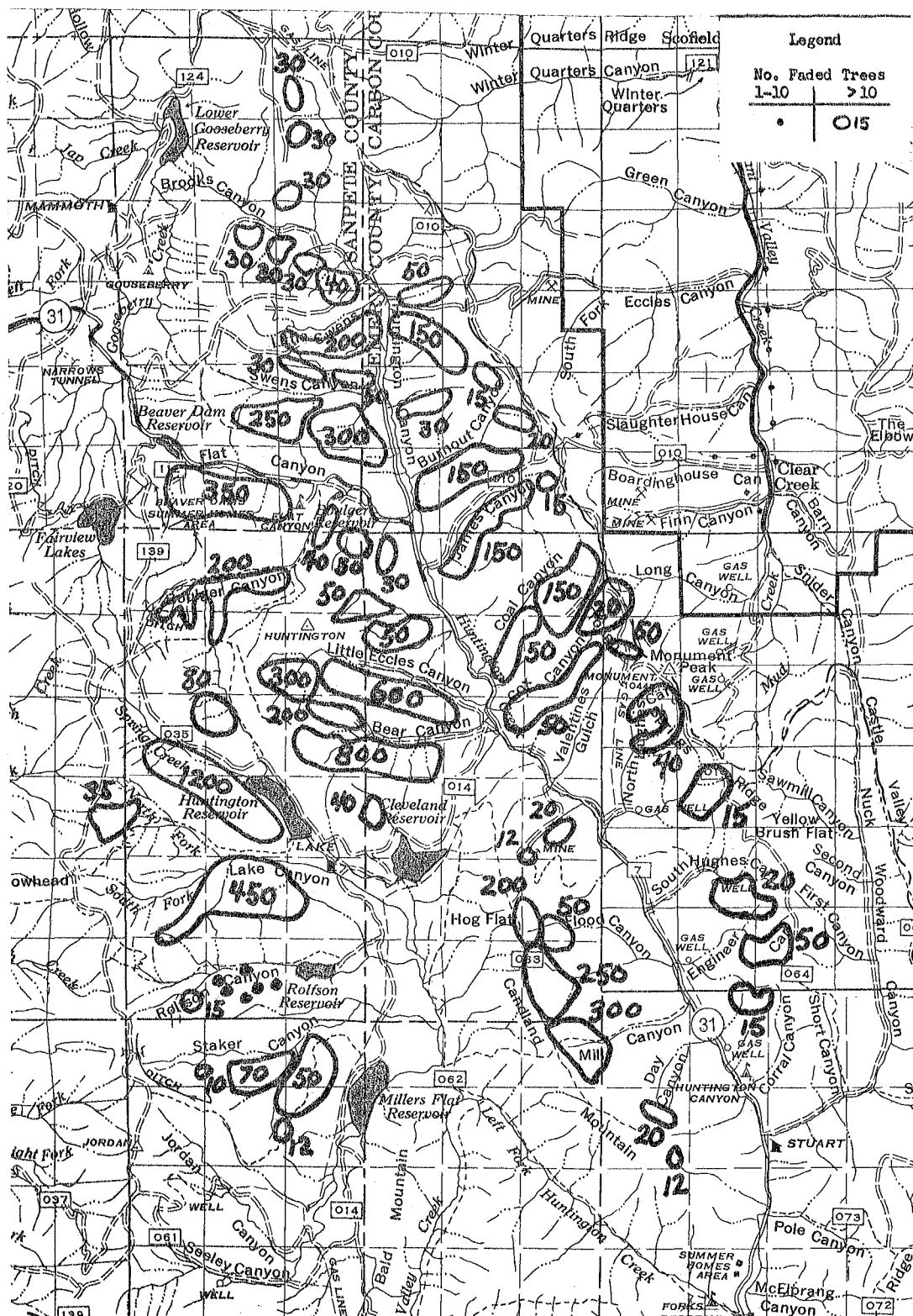


Figure 1. Aerial survey map showing the extent of the Engelmann spruce beetle outbreak on the Manti-LaSal National Forest, 1973.

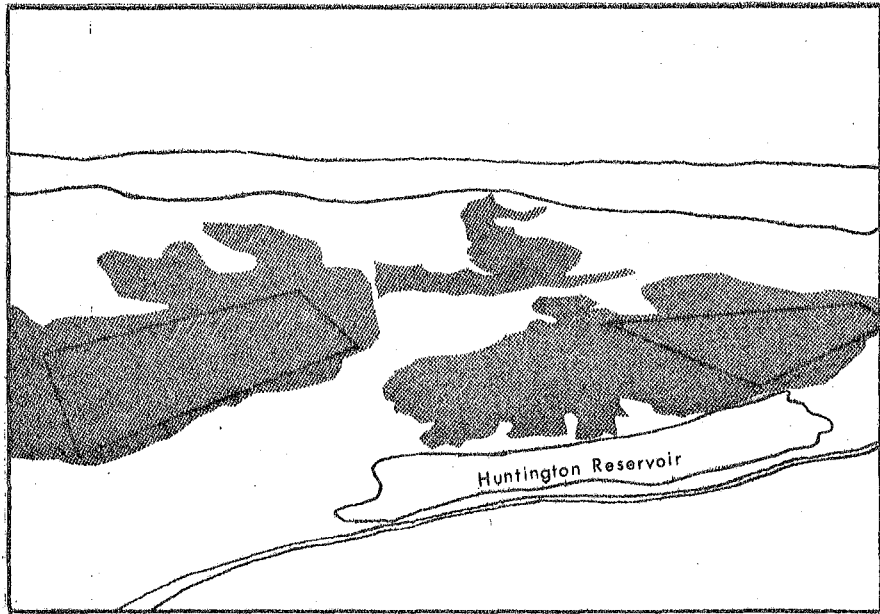


Figure 2. The drawing shows the general sample areas in Lake Canyon (left) and Spring Canyon (right). An infrared aerial photograph shows the same area (Manti-LaSal National Forest, 1973). Trees killed by the Engelmann spruce beetle appear green, and live trees appear purple. Photograph taken by William H. Klein.

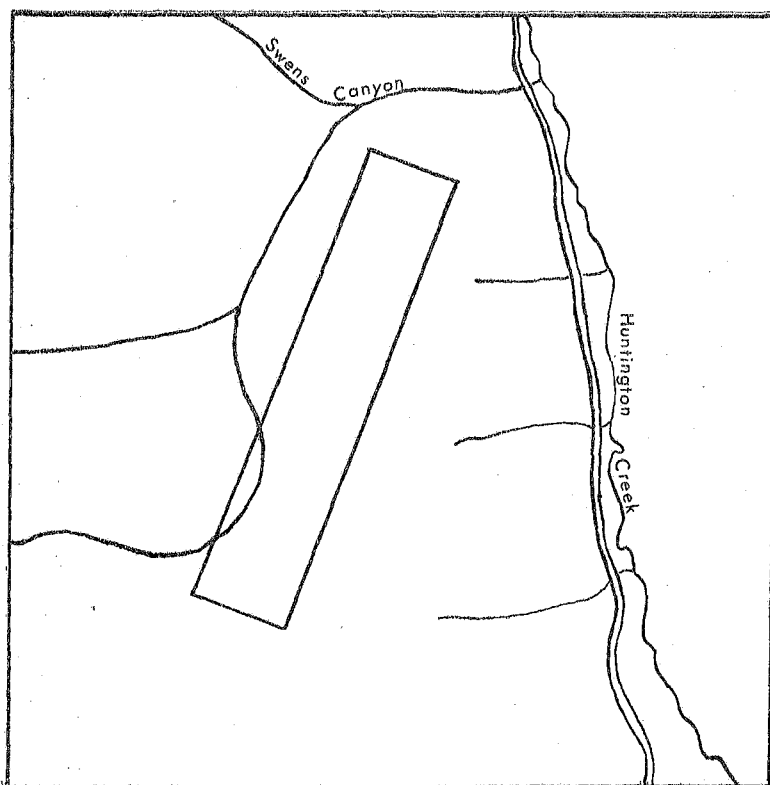


Figure 3. Drawing shows the location of the Swens Canyon sample area. Scale: 4 inches = 1 mile.

Figure 4. Infrared (left) and color (right) aerial photographs show the Engelmann spruce, subalpine fir, and aspen stand in Spring Canyon, Manti-LaSal National Forest, 1973. Exceptionally heavy tree losses have occurred as a result of the Engelmann spruce beetle. On the infrared photograph, purple colored trees are living and green trees are dead. Tree losses are heavier than it appears on the photographs, because many of the trees that appear alive have been attacked by the beetle and will die next spring. Photographs taken by William H. Klein.

Table 1. Summary of tree per acre and volume estimates collected in Lake Canyon on the Manti-LaSal National Forest, 1973.

Diameter Class(in.)	Engelmann Spruce		Subalpine Fir	Aspen	Total	Est. Mean Height	Per Tree	Volume Per Acre (Bd.Ft. Scribner)		
	Live	Dead						Live	Dead	Total
5	9.7	--	--	--	9.7	--	--	--	--	--
6	2.1	0.1	9.1	--	11.3	--	--	--	--	--
7	8.4	--	10.0	--	18.4	--	--	--	--	--
8	10.2	0.1	1.2	--	11.5	--	--	--	--	--
9	3.9	0.2	2.0	--	6.1	60	44	171.6	8.8	180.4
10	4.1	0.2	4.1	1.7	10.1	60	57	233.7	11.4	245.1
11	7.3	0.2	2.1	0.7	10.3	60	72	525.6	14.4	540.0
12	4.0	0.5	3.9	--	8.4	60	87	348.0	43.5	391.5
13	3.9	0.9	2.5	0.5	7.8	70	124	483.6	111.6	595.2
14	4.6	0.8	1.6	0.4	7.4	70	146	671.6	116.8	788.4
15	6.9	1.3	1.1	0.4	9.7	75	182	1255.8	236.6	1492.4
16	4.8	1.5	0.6	0.6	7.5	75	209	1003.2	313.5	1316.7
17	2.5	1.3	0.6	1.1	5.5	80	254	635.0	330.2	965.2
18	4.0	1.0	0.3	0.5	5.8	80	286	1144.0	286.0	1430.0
19	3.4	1.5	0.5	0.5	5.9	90	361	1227.4	541.5	1768.9
20	2.2	1.0	0.6	0.2	4.0	90	402	884.4	402.0	1286.4
21	1.8	0.7	--	--	2.5	90	461	829.8	322.7	1152.5
22	1.9	1.2	0.2	0.2	3.5	90	506	961.4	607.2	1568.6
23	0.9	0.4	0.1	--	1.4	90	553	497.7	221.2	718.9
24	0.8	0.5	--	--	1.3	90	602	481.6	301.0	782.6
25	0.5	0.4	--	--	0.9	90	653	326.5	261.2	587.7
26	0.5	0.1	--	--	0.6	90	702	351.0	35.1	386.1
27	0.3	--	--	--	0.3	90	761	228.3	--	228.3
28	0.2	--	0.1	--	0.3	90	819	163.8	--	163.8
29	0.1	--	--	--	0.1	90	878	87.8	--	87.8
30	0.1	0.1	--	--	0.2	90	940	94.0	94.0	188.0

Continued

(Table 1, Continued)

Diameter Class(in.)	Engelmann Spruce		Subalpine Fir	Aspen	Total	Est. Mean Height	Per Tree	Volume Per Acre (Bd.Ft. Scribner)		
	Live	Dead						Live	Engelmann Spruce Dead	Total
31	--	--	--	--	--	90	1003	--	--	--
32	--	--	0.1	--	0.1	90	1069	--	--	--
33	--	--	--	--	--	90	1137	--	--	--
34	0.1	0.1	--	--	0.2	90	1206	120.6	120.6	241.2
35	--	--	--	--	--	90	1278	--	--	--
36	--	--	--	--	--	90	1352	--	--	--
37	--	--	--	--	--	90	1428	--	--	--
38	--	0.1	--	--	0.1	90	1507	--	150.7	150.7
Total	89.2	14.2	40.7	6.8	150.9			12,726.4	4,530.0	17,256.4
Percent	59	10	27	4	100			74	26	100

Table 2. Summary of tree per acre and volume estimates collected in Spring Canyon on the Manti-LaSal National Forest, 1973.

Diameter Class(in.)	Engelmann Spruce		Subalpine Fir	Aspen	Total	Est. Mean Height	Per Tree	Volume Per Acre (Bd.Ft. Scribner)		
	Live	Dead						Live	Engelmann Spruce Dead	Total
5	--	0.1	8.3	--	8.4	--	--	--	--	--
6	1.5	0.3	7.3	--	9.1	--	--	--	--	--
7	2.2	0.3	5.4	1.3	9.2	--	--	--	--	--
8	1.6	0.9	5.1	--	7.6	--	--	--	--	--
9	3.2	0.8	7.4	--	11.4	60	44	140.8	35.2	176.0
10	3.8	1.1	3.8	0.6	9.3	60	57	216.6	62.7	279.3
11	2.7	1.6	4.9	--	9.2	60	72	194.4	115.2	309.6
12	2.9	1.7	4.2	--	8.8	60	87	252.3	147.9	400.2
13	2.7	2.4	3.8	0.3	9.2	70	124	334.8	297.6	632.4
14	1.7	1.7	1.9	--	5.3	70	146	248.2	248.2	496.4
15	1.2	2.1	2.7	--	6.0	75	182	218.4	382.2	600.6
16	1.5	2.4	2.8	0.4	7.1	75	209	313.5	501.6	815.1
17	1.3	2.4	1.1	0.2	5.0	80	254	330.2	609.6	939.8
18	0.5	2.9	1.4	0.2	5.0	80	286	143.0	829.4	972.4
19	0.3	2.9	1.4	--	4.6	90	361	108.3	1046.9	1155.2
20	0.1	3.2	1.1	0.3	4.7	90	402	40.2	1286.4	1326.6
21	0.4	1.7	0.6	--	2.7	90	461	184.4	783.7	968.1
22	0.1	2.7	0.4	0.3	3.5	90	506	50.6	1366.2	1416.8
23	--	1.9	1.1	0.1	3.1	90	553	--	1050.7	1050.7
24	--	1.6	0.1	0.3	2.0	90	602	--	963.2	963.2
25	0.1	1.1	0.1	--	1.3	90	653	65.3	718.3	783.6
26	0.1	1.1	--	--	1.2	90	702	70.2	772.2	842.4
27	--	0.6	0.2	--	0.8	90	761	--	456.6	456.6

Continued

(Table 2, Continued)

Diameter Class(in.)	Engelmann Spruce		Subalpine Fir	Aspen	Total	Est. Mean Height	Per Tree	Volume Per Acre (Bd.Ft. Scribner)		
	Live	Dead						Live	Engelmann Spruce Dead	Total
28	--	0.6	--	--	0.6	90	819	--	491.4	491.4
29	--	0.2	--	--	0.2	90	878	--	175.6	175.6
30	--	0.1	--	--	0.1	90	940	--	94.0	94.0
31	0.1	0.1	0.1	--	0.3	90	1003	100.3	100.3	200.6
32	--	0.3	0.1	--	0.4	90	1069	--	320.7	320.7
33	--	0.2	--	--	0.2	90	1137	--	227.4	227.4
34	--	0.2	--	--	0.2	90	1206	--	241.2	241.2
35	--	--	--	--	--	90	1278	--	--	--
36	--	0.1	--	--	0.1	90	1352	--	135.2	135.2
37	--	0.1	0.1	--	0.2	90	1428	--	142.8	142.8
38	--	--	--	--	--	90	1507	--	--	--
39	--	0.1	--	--	0.1	90	1587	--	158.7	158.7
Total	28.0	39.5	65.4	4.0	136.9			3,011.5	13,761.1	16,772.6
Percent	20	29	48	3	100			18	82	100

Table 3. Summary of tree per acre and volume estimates collected in Swens Canyon on the Manti-LaSal National Forest, 1973.

Diameter Class(in.)	Engelmann Spruce		Subalpine Fir	Aspen	Total	Est. Mean Height	Per Tree	Volume Per Acre (Bd.Ft. Scribner)		
	Live	Dead						Live	Dead	Total
5	12.9	0.1	--	4.1	17.1	--	--	--	--	--
6	13.2	--	10.0	9.4	32.6	--	--	--	--	--
7	7.1	0.1	9.5	2.3	19.0	--	--	--	--	--
8	8.5	0.4	8.7	--	17.6	--	--	--	--	--
9	1.3	0.5	9.8	2.8	14.4	60	44	57.2	22.0	79.2
10	3.5	0.4	5.5	1.2	10.6	60	57	199.5	22.8	222.3
11	4.4	0.7	4.7	2.8	12.6	60	72	316.8	50.4	367.2
12	4.8	1.5	2.4	0.8	9.5	60	87	417.6	130.5	548.1
13	1.4	1.6	2.7	4.1	9.8	70	124	173.6	198.4	372.0
14	4.1	3.1	1.1	4.5	12.8	70	146	598.6	452.6	1051.2
15	2.1	3.5	1.5	1.0	8.1	75	182	382.2	637.0	1019.2
16	2.2	3.7	1.3	1.8	9.0	75	209	459.8	773.3	1233.1
17	1.9	3.6	1.2	--	6.7	80	254	482.6	914.4	1397.0
18	0.7	4.0	0.7	0.3	5.7	80	286	200.2	1144.0	1344.2
19	--	2.7	0.3	0.6	3.6	90	361	--	974.7	974.7
20	--	1.9	0.5	--	2.4	90	402	--	763.8	763.8
21	--	1.5	--	--	1.5	90	461	--	691.5	691.5
22	0.2	0.7	0.5	--	1.4	90	506	101.2	354.2	455.4
23	--	1.7	--	--	1.7	90	553	--	940.1	940.1
24	--	0.3	0.6	--	0.9	90	602	--	180.6	180.6
25	--	0.7	--	--	0.7	90	653	--	457.1	457.1
26	--	--	--	--	--	90	702	--	--	--

Continued

(Table 3, Continued)

Diameter Class(in.)	Engelmann Spruce		Subalpine Fir	Aspen	Total	Est. Mean Height	Per Tree	Volume Per Acre (Bd.Ft. Scribner)		
	Live	Dead						Live	Engelmann Spruce Dead	Total
27	0.1	0.3	--	--	0.4	90	761	76.1	228.3	304.4
28	--	0.1	--	--	0.1	90	819	--	81.9	81.9
29	--	--	--	--	--	90	878	--	--	--
30	--	--	--	--	--	90	940	--	--	--
31	--	--	--	--	--	90	1003	--	--	--
32	--	--	--	--	--	90	1069	--	--	--
33	--	--	--	--	--	90	1137	--	--	--
34	--	--	--	--	--	90	1206	--	--	--
35	--	--	--	--	--	90	1278	--	--	--
36	--	--	--	--	--	90	1352	--	--	--
37	--	0.1	--	--	0.1	90	1428	--	142.8	142.8
Total	68.4	33.2	61.0	35.7	198.3			3,465.4	9,160.4	12,625.8
Percent	34	17	31	18	100			27	73	100

Table 3. Statistical estimators of sample populations for the Lake Canyon, Spring Creek, and Swens Canyon survey tracts (Manti-LaSal National Forest, 1973).

Statistical Estimators	STAND CONDITIONS SAMPLED (TREES/ACRE)					
	Lake Canyon		Spring Creek		Swens Canyon	
	Live	Dead	Live	Dead	Live	Dead
Mean	89.51	14.19	28.08	39.87	68.47	33.07
Standard Deviation	83.23	18.12	35.29	17.70	96.54	20.64
Standard Error	12.41	3.95	4.28	3.13	16.81	5.33
Confidence Interval (95%)	64.50 114.52	5.95- 22.43	19.54 36.62	33.49- 46.25	34.27- 102.67	21.64- 44.50

Table 4. Statistical estimators of sample populations for the Lake Canyon, Spring Creek, and Swens Canyon survey tracts (Manti-LaSal National Forest, 1973).

Statistical Estimators	STAND CONDITIONS SAMPLED (TREES/ACRE)					
	Lake Canyon		Spring Creek		Swens Canyon	
	Live	Dead	Live	Dead	Live	Dead
Mean	89.51	14.19	28.08	39.87	68.47	33.07
Standard Deviation	83.23	18.12	35.29	17.70	96.54	20.64
Standard Error	12.41	3.95	4.28	3.13	16.81	5.33
Confidence Interval (95%)	64.50 114.52	5.95- 22.43	19.54 36.62	33.49- 46.25	34.27- 102.67	21.64- 44.50